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RADIOLOGICAL APPRAISAL OF THE MONTICELLO PROJECT SAN JUAN COUNTY MONTICELLO, UTAH

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HEALTH AND SAFETY DIVISION
IDAHO OPERATIONS OFFICE
U. S. ATOMIC ENERGY COMMISSION

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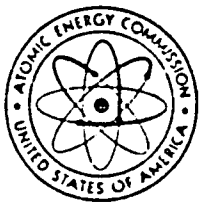
Herman J. Paas, Jr.



Idaho Operations Office
U. S. ATOMIC ENERGY COMMISSION

ACKNOWLEDGEMENTS

The author takes this opportunity to express his sincere appreciation for the cooperation and diligence displayed by the Grand Junction and Idaho Operations Office Radiological Assistance Team members who participated in the survey. The courtesy and competence demonstrated throughout the survey was doubly gratifying in view of the adverse weather conditions and pressures of timeliness encountered during the performance of this assignment.

ABSTRACT

Measurements and recommendations resulting from a radiological appraisal of the Monticello Project are presented. This appraisal was performed following completion of an erosion control project which included stabilization, covering, and seeding of exposed tailings areas. Evaluation of environmental samples of air, vegetation, and water shows no evidence of radioactive material transport from tailings and ore storage areas. Several hundred dose rate measurements taken over the tailings area show that the average whole body exposure to a population maintaining 24-hr/day occupancy would be measurably below the levels believed to be harmful or injurious to health. Similar data were collected at the mill and foundation areas. Except for the generally contaminated foundation area, the site conditions meet criteria that allow release for public usage. Surface occupancy can be permitted on a nonrestricted basis; however, the presence of subsurface contaminants at the tailings area require control, as any disturbance of existing terrain could materially change the radiological conditions found at the time of this survey.

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RADIOLOGICAL APPRAISAL OF THE MONTICELLO PROJECT
SAN JUAN COUNTY
MONTICELLO, UTAH

1. PURPOSE

Early in May 1965, the Idaho Operations Office was requested by the Director, Operational Safety, HQ, to perform an independent evaluation of radiological conditions at the Monticello Project[1]. A survey was made later that month, and this report summarizes the results.

2. LOCATION AND DESCRIPTION

The AEC-owned site is located in San Juan County, Utah, adjoining the southern boundary of the town of Monticello. For purposes of this evaluation, the site was divided into contiguous areas which include the tailings area, the ore storage area, the old administration area, and the mill foundation area. The geographic locations of the reference areas are illustrated on Figure 1. Two small portions of the site which were not directly involved in ore storage or mill operations were previously transferred to the Bureau of Land Management and the City of Monticello. These areas are indicated as the shaded portions on Figure 1. The appraisal of residual radiological conditions was intended to complement previous site restoration and survey efforts which had been completed at the site following shutdown of the mill in early 1960[2].

2.1 Tailings Area

During mill operation in the period 1942 to 1960, nearly one million tons of tailings were accumulated and deposited over an area of some 40 acres immediately east of the mill site. The overall area includes five separate tailing accumulations resulting from changes in process and mill operation. These are commonly referred to as the east and west tailings, vanadium tailings, acid tailings, and the alluvial wash water area (Figure 1). Four years ago the gross tailing area was graded to promote drainage and covered to a depth of 12 to 24 inches with approximately 135,000 cubic yards of rock and soil[3]. After fertilizing, the area was seeded with grasses which have now established a cover comparable to or exceeding that of the adjoining San Juan County area. Tailing problems associated with wind and water erosion and physical hazards associated with quicksand-type slimes were eliminated. Additionally,

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[1] Letter: Radiological Survey of the Monticello Site, Woodruff to Ginkel, May 5, 1965.

[2] Grand Junction Office, AEC, Monticello Mill Tailing Erosion Control Project, Monticello, Utah, RMO-3005 (December 1963).

[3] Ibid.

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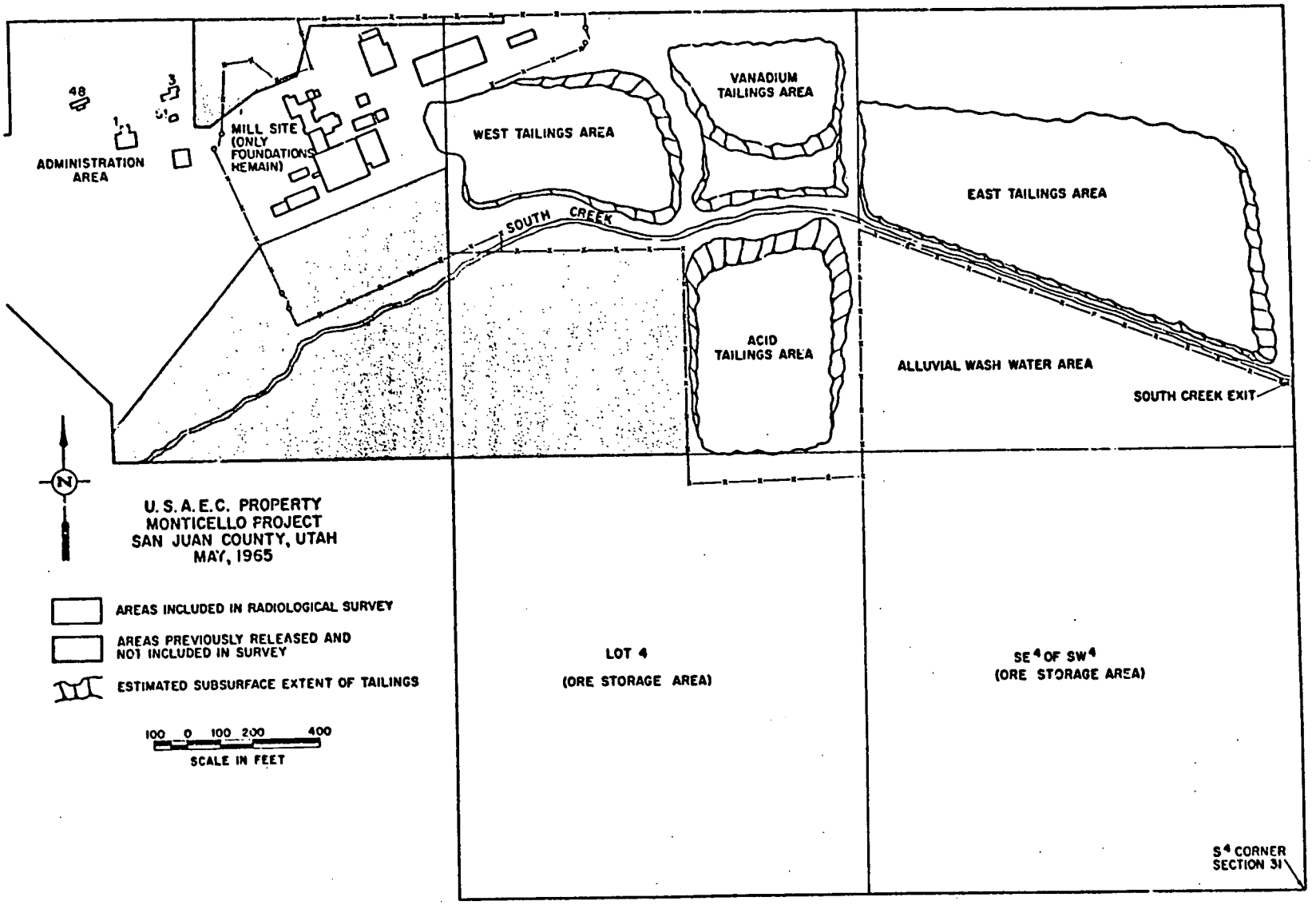

Fig. 1 USAEC property -- Monticello Project, San Juan County, Utah, May, 1965.

the trace gamma radiation emitted from tailings, which is nearly identical to that measured from untreated ore, was expected to be reduced to negligible values by the attenuation effect of the soil and rock cover.

2.2 Ore Storage Area

This area covers about 80 acres along the south site perimeter. Untreated ore was stored in this area in random piles covering several thousand square feet each. The ore was processed prior to mill closure, and the terrain was cleaned to the extent that no visual evidence of ore remained. An estimated 20 to 25 acres on the east end of the storage area is covered by heavy thicket and scrub growth and was never used or traversed for ore storage purposes.

2.3 Administration Area

The administration area covers approximately ten acres in the northwest corner of the project and, at a slightly higher elevation, overlooks the remaining site. Several buildings have been removed from this area, and only five remained at the time of the survey. A few pieces of equipment that were used at the time the mill was operating were stored in these buildings.

2.4 Foundation Area

The mill foundation area contains the concrete foundations and floor areas of the process buildings. The buildings and contents were removed, destroyed, or buried concurrent with the tailings stabilization program in 1961.

3. SURVEY PLAN

3.1 Personnel

Personnel performing the survey were members of the Region VI Radiological Assistance Teams at Idaho Falls and Grand Junction. Coordination with the GJ team proved valuable as the GJ Office had administrative responsibilities over the mill operation and had administered all prior restorative action at the site.

3.2 Outside Officials Participating

Invitations to participate in or observe the radiological survey were extended to interested officials at the local, state, and regional levels of varied public interests. Observers present at the site included:

Clarence Rogers, Civil Defense Director, San Juan County, Utah.

Dr. Grant S. Winn, Head, Industrial Hygiene Section, Utah Department of Public Health, Salt Lake City, Utah.

Leo J. Dymerski, Regional Program Director for Radiological Health, Denver, Colorado.

Roger T. Woolsey, Division of Compliance, Denver, Colorado.

Invitees who were invited but could not attend due to other commitments, or due to the influence of travel distance, included: Dr. Victor Archer, USPHS of Salt Lake City, Utah; Glenn Brown of Region IV, Division of Compliance, Denver, Colorado; and representatives of public health departments in Wyoming, Colorado, New Mexico, South Dakota, and Arizona[4]. The latter States represented those having uranium mills within their boundaries.

3.3 Equipment

Basic equipment used was that contained in the RAT alpha-beta-gamma emergency monitoring kits[5]. Beta-gamma measurements were obtained with an Eberline Model E-510, and alpha measurements were obtained with an Eberline PAC-IS scintillation counter. Air samples were collected using a high-volume Staplex sampler, Model TFIA-4, employing a MSA 2133 filter through which air was motivated with a 24-volt dc rechargeable battery supply. Film badges worn by crew personnel and exposed around the site perimeter for accumulated dose evaluations were NRTS environmental film packets, containing DuPont Type 558 film.

3.4 Measurements

Radiation and contamination levels were determined by portable instrument survey measurements at locations necessary for adequate evaluation of the item under appraisal. For example, building foundations and items of equipment were surveyed on all exposed surfaces. Open terrain involving considerable acreage was surveyed on a grid at 100-foot intervals. Frequency of measurements was increased at interest points, such as scrap disposal grounds, sump boxes, etc. Dose rate measurements of equipment were made at one inch from the item being surveyed. Dose rates over open terrain were made at the surface and at a location three feet above the surface. Beta-gamma and gamma readings were obtained at each terrain monitoring location.

Alpha measurements were performed on all equipment and interiors of buildings. Select measurements were also made at open field locations where initial beta-gamma measurements indicated potential alpha contamination.

Air samples were collected at three site locations (Figure 2) and one background location during the survey. The collected samples were returned to the ID Health and Safety Laboratory for analysis.

In addition to the film packets worn by survey crew personnel during the survey, fifteen environmental packets were placed three feet above ground at representative field and perimeter locations (Figure 2). These were exposed for 24 days after which they were collected by the Civil Defense Director of San Juan County and returned to ID for processing.

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[4] Letter: Inviting Officials Outside AEC to Attend Radiation Survey at Monticello, R. J. Gidney, GJO, USAEC, May 20, 1965.

[5] A. W. Holmes (comp.), Radiological Assistance Plan, Region 6, J. R. Horan (ed.), IDO-12013 (Rev. 1) (October 1963) p 32.

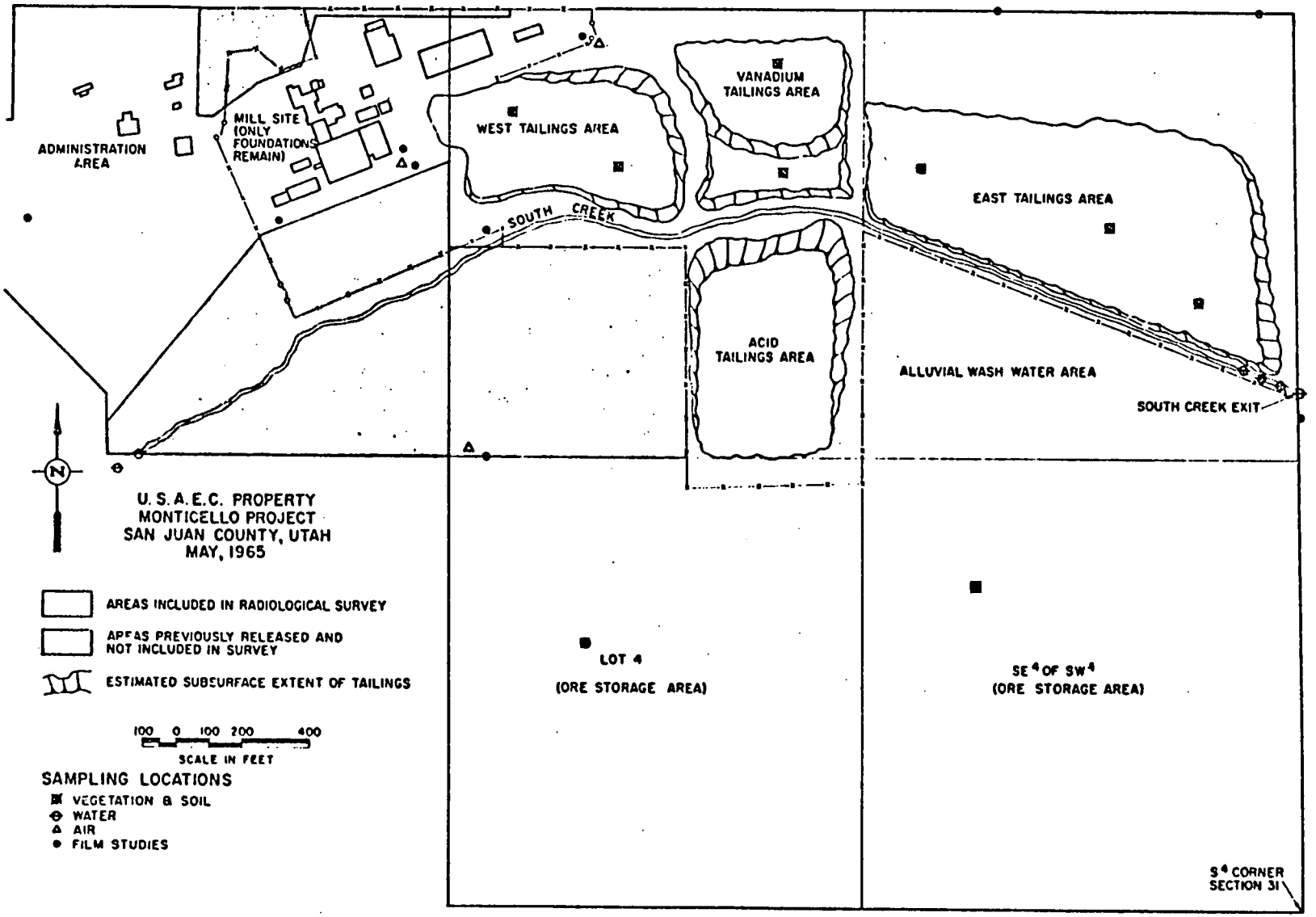

Fig. 2 USAEC property -- Monticello Project, San Juan County, Utah, May, 1965 -- Sampling Locations.

Environmental samples of soil, water, and vegetation were collected from the numerous interest areas and analyzed for gross beta-gamma and alpha emitters in the ID Health and Safety Laboratory. These data were supplemented with more detailed analysis if the gross activity measurements indicated significance above background. Natural background radiation was evaluated daily from instrument readings taken at remote locations. Contributions of natural emitters such as potassium-40 to the environment was determined from vegetation and soil samples collected several miles from the project.

4. SURVEY RESULTS AND RECOMMENDATIONS

4.1 Tailings Area

Analysis of the data obtained from the radiation dose rate measurements can be analyzed in one of two ways. Each of the five tailing piles can be considered independently, or all five contiguous piles can be viewed as one large tailings area.

The negligible difference in average dose rates measured over the individual tailing piles tends to give preference to viewing the area as a whole. Supporting this approach is the fact that although the individual piles were well defined prior to stabilization, the stabilization effort involved movement and interchange of large volumes of slime and slurry in addition to a combining effect resulting from the lowering and tapering of the dikes[6].

Table I summarizes the results obtained from portable instrument surveys performed over the individual tailing piles and also shows the summary values for the entire area.

Figures 3, 4, 5, 6, and 7 show the individual measurements from which the average values in Table I were computed and also define the locations at which the measurements were obtained.

Comparison of the survey results to the natural background in the surrounding Monticello area reflects very little difference indicating that very little gamma radiation penetrates through the rock and soil cover on the tailings piles. Natural background evaluated on ten occasions at locations in commercial and residential areas of Monticello and at the north city limits during the three-day period of the survey showed a range in dose rate from 0.02 to 0.05 mR/hour. Surface values ranged from 0.02 to 0.05 mR/hour, and values three feet above ground ranged from 0.02 to 0.04 mR/hour. The average background reading obtained at the surface was 0.036 mR/hour and, at three feet above ground, was 0.032 mR/hour. Using these values versus those summarized in Table I, the dose rate contributed by the tailings averages 0.008 mR/hour at the surface and at three feet above the ground.

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[6] Grand Junction Office, AEC, Monticello Mill Tailing Erosion Control Project, Monticello, Utah, RMO-3005 (December 1963).

TABLE I

SUMMARY OF RADIATION DOSE RATE
MEASUREMENTS -- MONTICELLO PROJECT TAILINGS AREAS
(May 25, 26, and 27, 1965)

Location	Total Number of Measurements	Average Gamma Dose Rate (mR/hour)	
		Surface	Three Feet Above Surface
East Tailings	292	0.041	0.038
Vanadium Tailings	88	0.041	0.035
West Tailings	86	0.056	0.053
Acid Tailings	114	0.052	0.044
Wash Water Area	114	0.035	0.033
Summary Data	694	0.044	0.040

To appraise the long-range hazard resulting from an exposure to a dose rate of this magnitude, the basic Radiation Protection Guides (RPG) employed by the Federal Radiation Council are referenced[7].

The whole body exposure for a population group having 24 hour/day residence at the Monticello tailing site on the basis of the measured 0.008 mR/hour dose rate is computed as 0.069 rem/year. This annual exposure is approximately 14 percent of the 0.5 rem permissible as defined in the basic Radiation Protection Guides established by the Federal Radiation Council[8]. Similarly, considering the worst individual case which involves the west tailings where the average dose rate was 0.02 mR/hour (0.056 mR/hour minus background of 0.036 mR/hour) the annual full occupancy whole body exposure would be 0.175 rem or 35 percent of the annual permissible amount. These calculations should be regarded as conservative as they assume the highly unlikely case of a residing individual maintaining surface contact at this location for 24 hours a day on an annual basis. Thus, it may be concluded that the radiation exposure encountered over the tailings piles is measurably below the levels believed to be harmful or injurious to the health of anyone occupying the area. The measured exposure allows release of the land for occupancy by the general public; however, it

[7] U. S. Federal Radiation Council, Report No. 1, Background Material for the Development of Radiation Protection Standards, Washington: U. S. Department of Health, Education, and Welfare, 1960. Sections 5.2, 5.3, 5.4, and 5.5.

[8] Ibid.

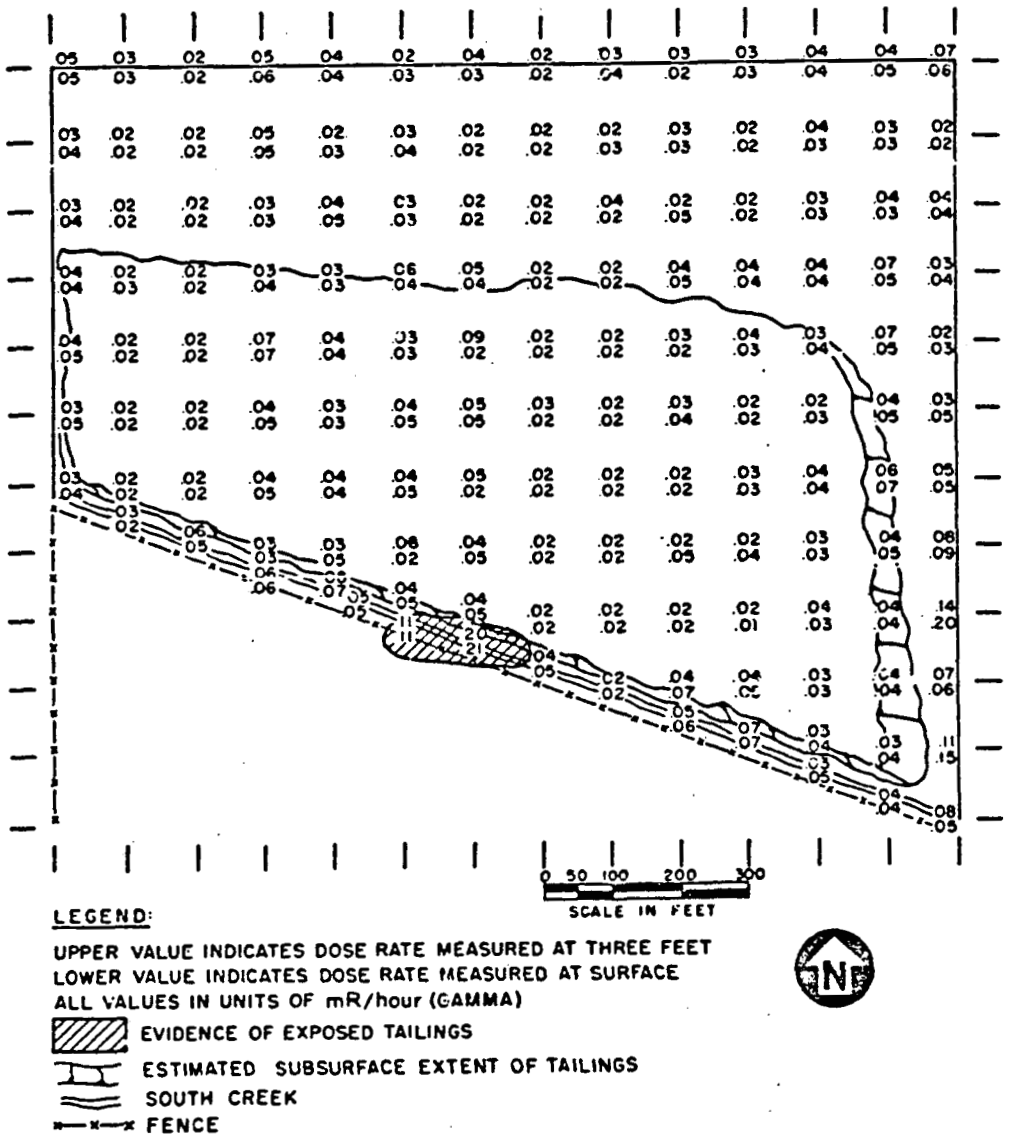

Fig. 3 Radiation survey measurements -- East Tailings Area, Monticello Project, San Juan County, Utah.

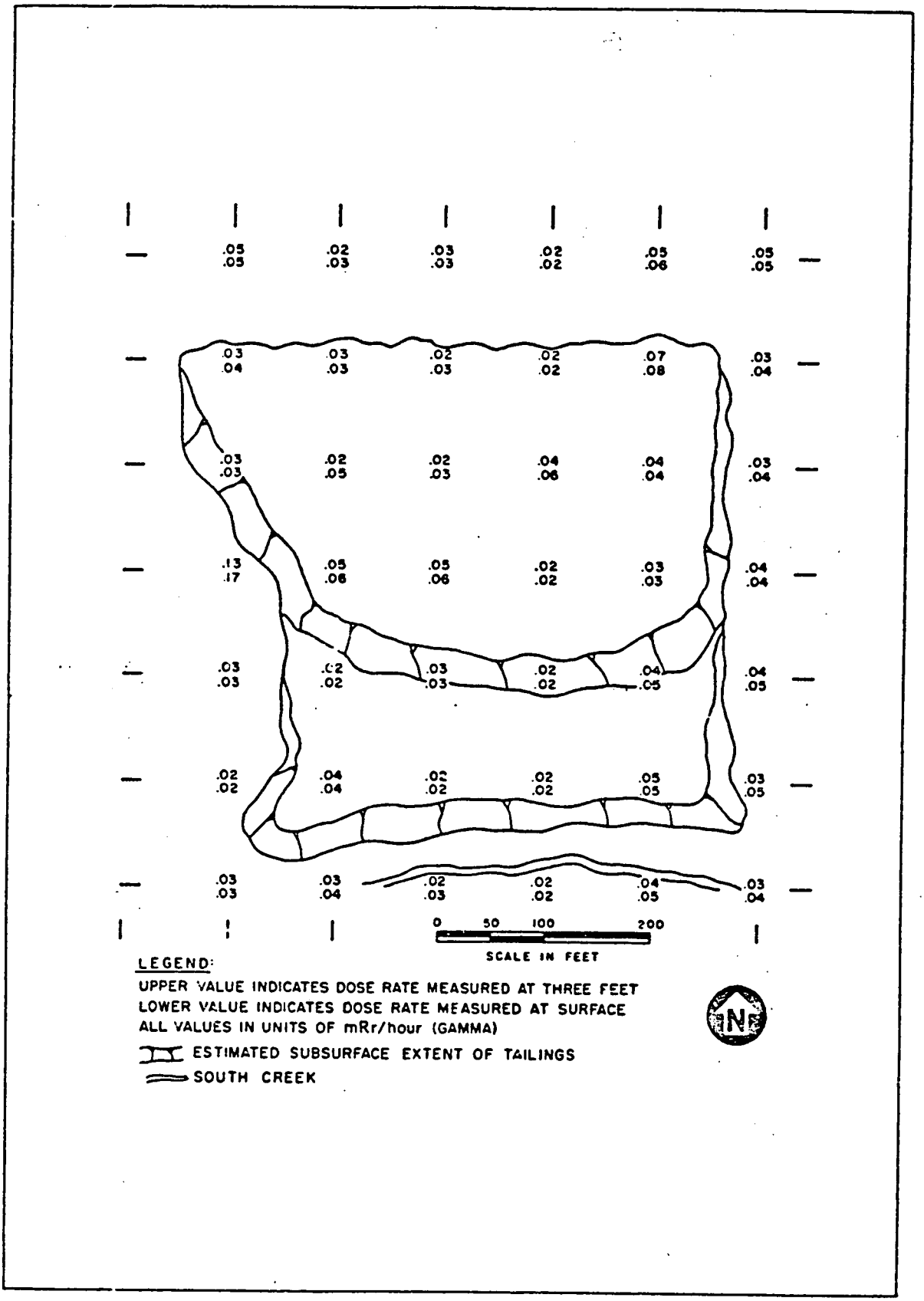

Fig. 4 Radiation survey measurements -- Vanadium Tailings Area, Monticello Project, San Juan County, Utah.

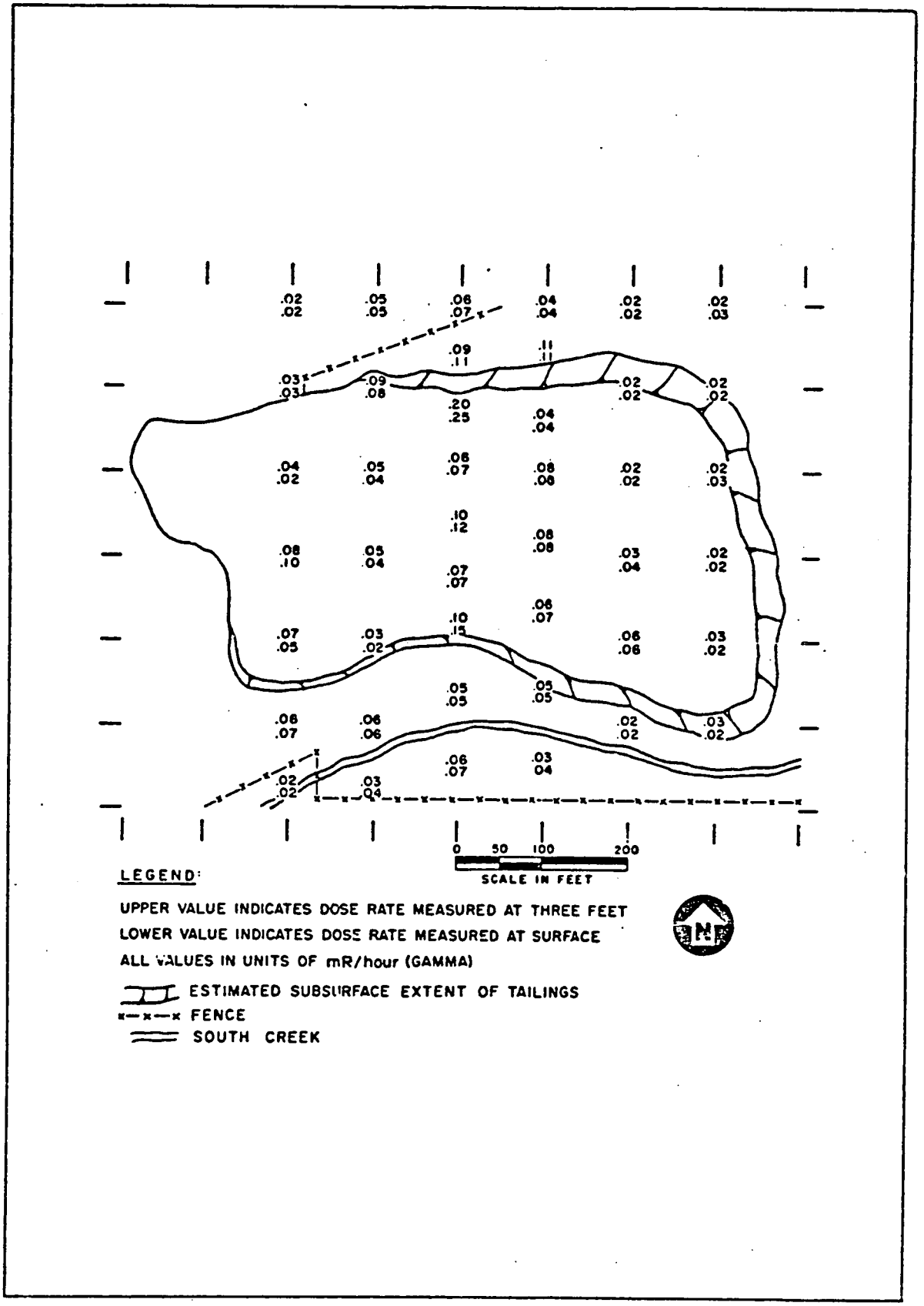

Fig. 5 Radiation survey measurements -- West Tailings Area, Monticello Project, San Juan County, Utah.

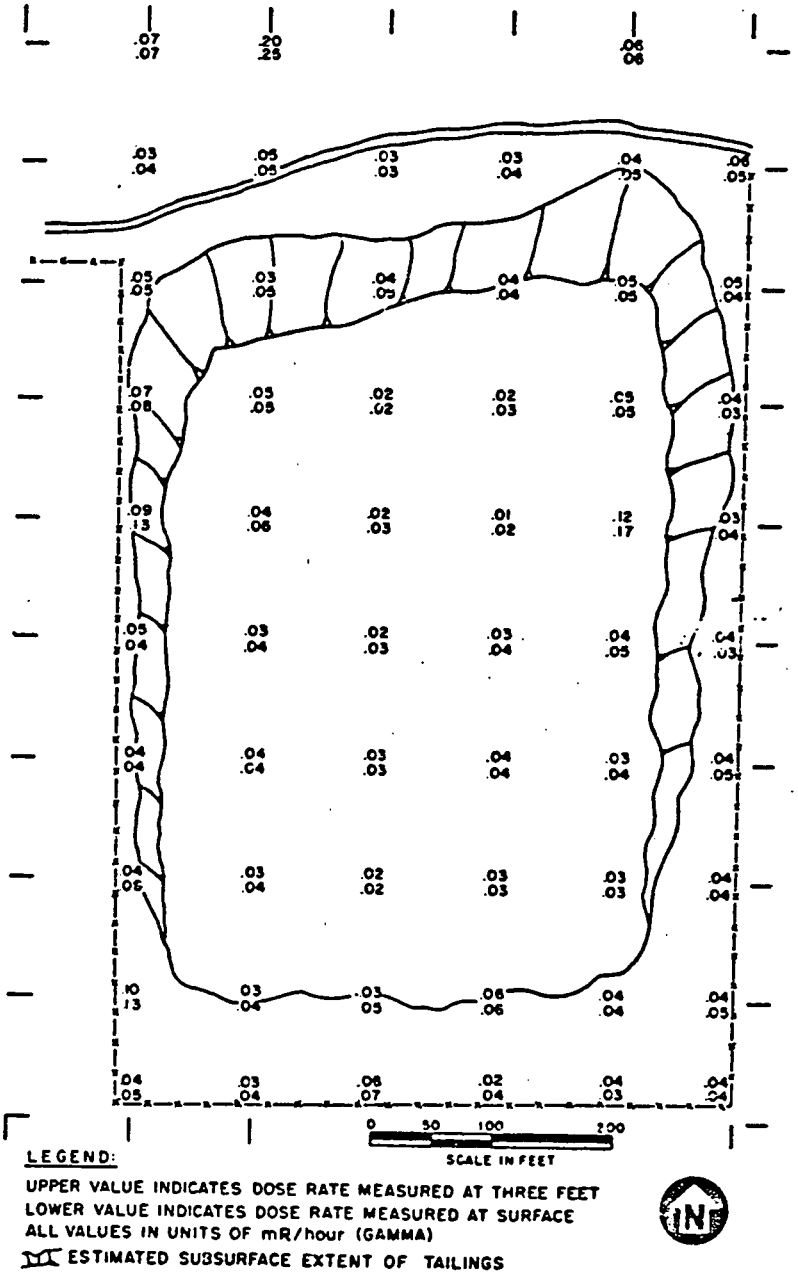

Fig. 6 Radiation survey measurements -- Acid Tailings Area, Monticello Project, San Juan County, Utah.

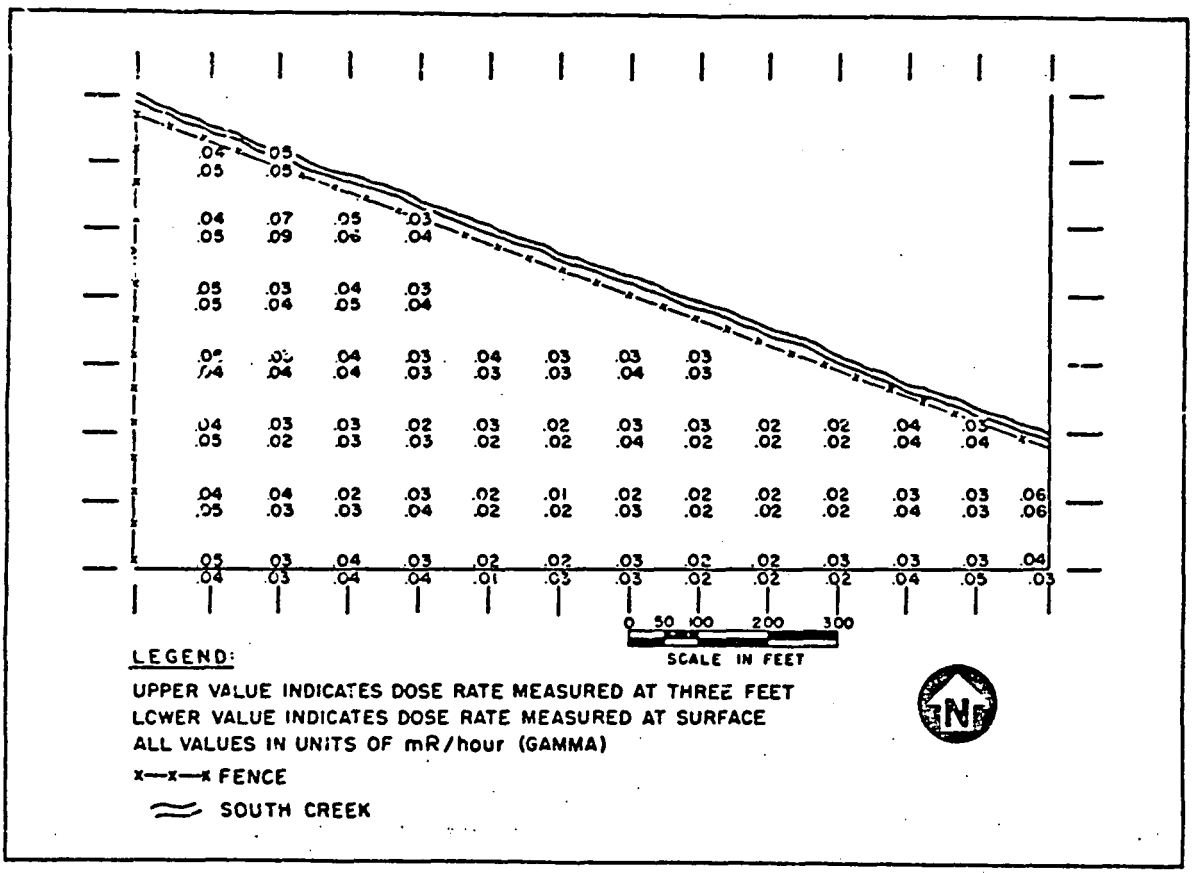

Fig. 7 Radiation survey measurements -- Alluvial Wash Water Area, Monticello Project, San Juan County, Utah.

should be noted that the recommended release of land is entirely based upon the potential whole body exposure for above surface occupancy. The existence of subsurface contaminants is known, and any disturbance of existing terrain could materially change the radiological conditions encountered at the time of this survey.

Samples of surface soil, water, and vegetation collected from the locations indicated in Figure 2 showed no evidence of leaching or uptake from the subsurface tailings. The activity density from beta-gamma emitters in these samples was within the range of normal background for the vicinity. Natural background in soil and vegetation was determined from samples collected at the north city limits of Monticello. The activity in water was measured as it entered the project at the highway bridge and again as it left the project near the Bailey Ranch.

Film badges worn by personnel participating in the three-day survey showed no detectable exposure to radiation. Five additional film packets were placed at locations over or near the tailings at a height of three feet above ground and were allowed to remain exposed for a 24-day period. The average exposure measured on these badges was 0.02 mR/hour, a background corrected value nearly identical to that determined from the voluminous number of portable instrument readings taken at a height of three feet above the tailings. Background film studies were performed across town at the Monticello north city limits and at the cemetery adjacent to the mill site.

4.2 Equipment Burial Ground

Two adjoining contaminated equipment burial grounds located in the west tailings area were covered and seeded by methods similar to those covering the surrounding tailings. Discussions with GJ personnel indicated that at the time facilities were dismantled, contaminated materials with dose rates to 26 mR/hour and alpha contamination to 2.0×10^6 disintegrations/minute/100 cm^2 (including 50,000 dis/min/100 cm^2 smearable) were buried at this location. An estimated cover of two to three feet of tailing sands preceded the rock and dirt cover added after the equipment burial was completed. The total surface area covered by the two buried sites was approximately 7500 ft^2.

Although the instrument measurements performed on the 100-foot grid survey over the west tailing area failed to identify any significant hazard emanating from these burial grounds, it was believed advisable to survey this area in greater detail as the subsurface debris offered a greater hazard potential than the surrounding tailings. Traverse grids were established at approximated 25-foot intervals, and instrument surveys were performed at each of the 16 representative locations (see Figure 8). Two measurements were obtained at each survey location — one at the surface using an instrument with conventional GM probe and another at a depth of one foot below surface using a GM probe enclosed in a thin-wall tube.

The surface readings ranged from 0.03 to 0.09 mR/hour with an average of 0.05 mR/hour. The average value was not significantly different than that measured over the surrounding tailings and was nearly identical to the background of 0.04 mR/hour established earlier the morning of the survey. As expected, the readings obtained a foot below the surface showed about a tenfold increase, ranging from 0.30 to 1.5 mR/hour and averaging 0.52 mR/hour. It may be concluded that the buried contaminated equipment is adequately covered and that the contaminated contents do not reflect any detectable increase in dose rate at the surface. Although surface occupancy by the public can be recommended on a nonrestricted basis, the existence of subsurface contaminants must be recognized, and any disturbance of existing terrain at this location would materially alter the radiological conditions found during this survey.

4.3 Ore Storage Area

Measurements were made at 228 locations over the accessible portion of approximately 80 acres. The summary results of this survey are presented in Table II, and the individual measurements which comprise the average values are presented in Figures 9 and 10.

Deducting background from the above values, the mean dose rate attributable to residual activity was 0.063 mR/hour at the surface and 0.048 mR/hour three feet above ground. Extrapolating these values on an annual basis results in a whole body exposure of 0.55 and 0.63 rem, respectively. These values slightly exceed the previously defined FRC Guides of 0.5 rem/year. This fact was not surprising as both visual observations at the site and evidence portrayed in the individual measurements define isolated areas showing relatively high radioactivity amid vast areas in which the general activity measured approximates background. The shaded areas in Figures 9 and 10 are examples of the more contaminated areas, whereas the grid measurements along the north border reflect typical natural background readings. It was apparent that although the

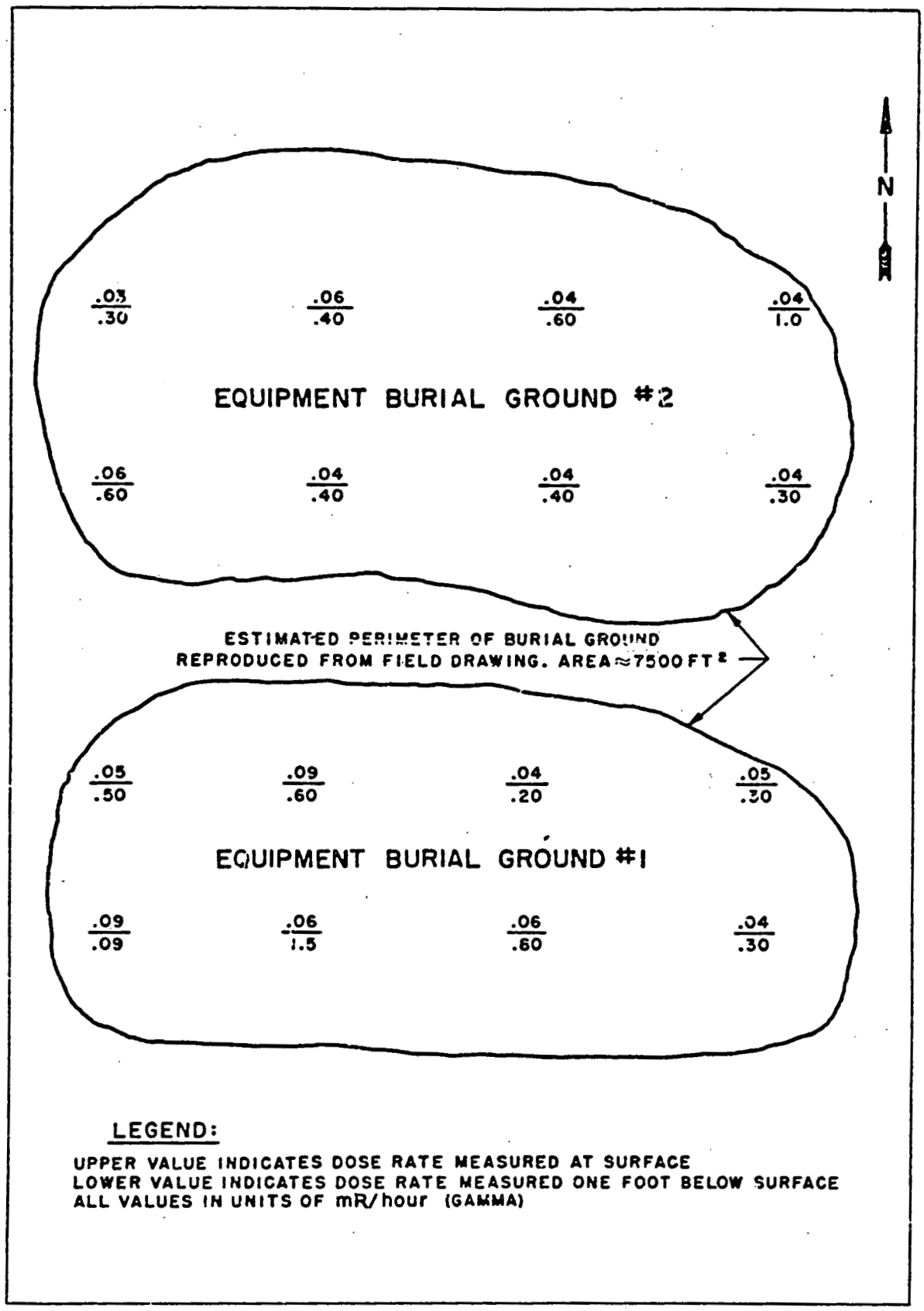

Fig. 8 Radiation survey measurements -- Equipment Burial Ground, Monticello Project, San Juan County, Utah, May 27, 1965.

TABLE II

SUMMARY OF RADIATION GAMMA DOSE RATE MEASUREMENTS -- MONTICELLO PROJECT ORE STORAGE AREA (May 25, 26, and 27, 1965)

Total Number of Measurements	Average Gamma Dose Rate (mR/hour)	
	Surface	Three Feet Above Surface
556	0.099	0.080

overall surface where storage piles existed has been cleared exceptionally well, some residual ore fragments remained lodged below the ground surface.

To check this assumption, the established survey pattern on 100-foot grids was briefly abandoned, and one survey crew was assigned to perform a detailed survey over a select area visually evident of having housed an ore storage pile. In the 6500-ft^2 area selected, approximately 2600 ft^2 was covered by vegetation. The survey was conducted over a measured 10 percent of the area which represented the bare and vegetated proportions determined earlier. Extrapolation of the results revealed that 140 pieces of ore were detectable with a GM meter at the surface. Some of these were partially exposed, and others became evident several inches below the surface. The average frequency of residual ore pieces was one piece every 46 square feet over the entire plot and, in the extreme case, was one piece every 33 square feet on non-vegetated surfaces. The maximum surface dose rate measured on an ore piece was 40 mR/hour; however, the majority of values were in the range of 0.4 to 15 mR/hour.

Another factor influencing the higher than expected average dose rate found over the ore storage area was a partially exposed burning ground located in an elongated draw. The uncovered portion of the burning ground was estimated at 4000 ft^2. Selected debris, of which charred lumber, corroded metal, and oil drums were typical, showed surface dose rates ranging to 2 mR/hour.

These findings over isolated areas of the 80-acre ore storage area prompted additional cleanup to eliminate the nominal hazard potential. Shortly after completion of the May survey, GJ undertook the additional cleanup and removed from 6 to 12 inches of the surface soil at storage pile locations. Detailed portable instrument surveys performed by GJ personnel following the cleanup showed no residual ore fragments and no detectable activity above natural background radiation.

Environmental samples collected from locations shown in Figure 2 during the May survey included soil, vegetation, and air. No contaminants were detected in air or vegetation. One soil sample showing trace activity was related to ore storage pile residue which was later removed in the GJ cleanup program described above.

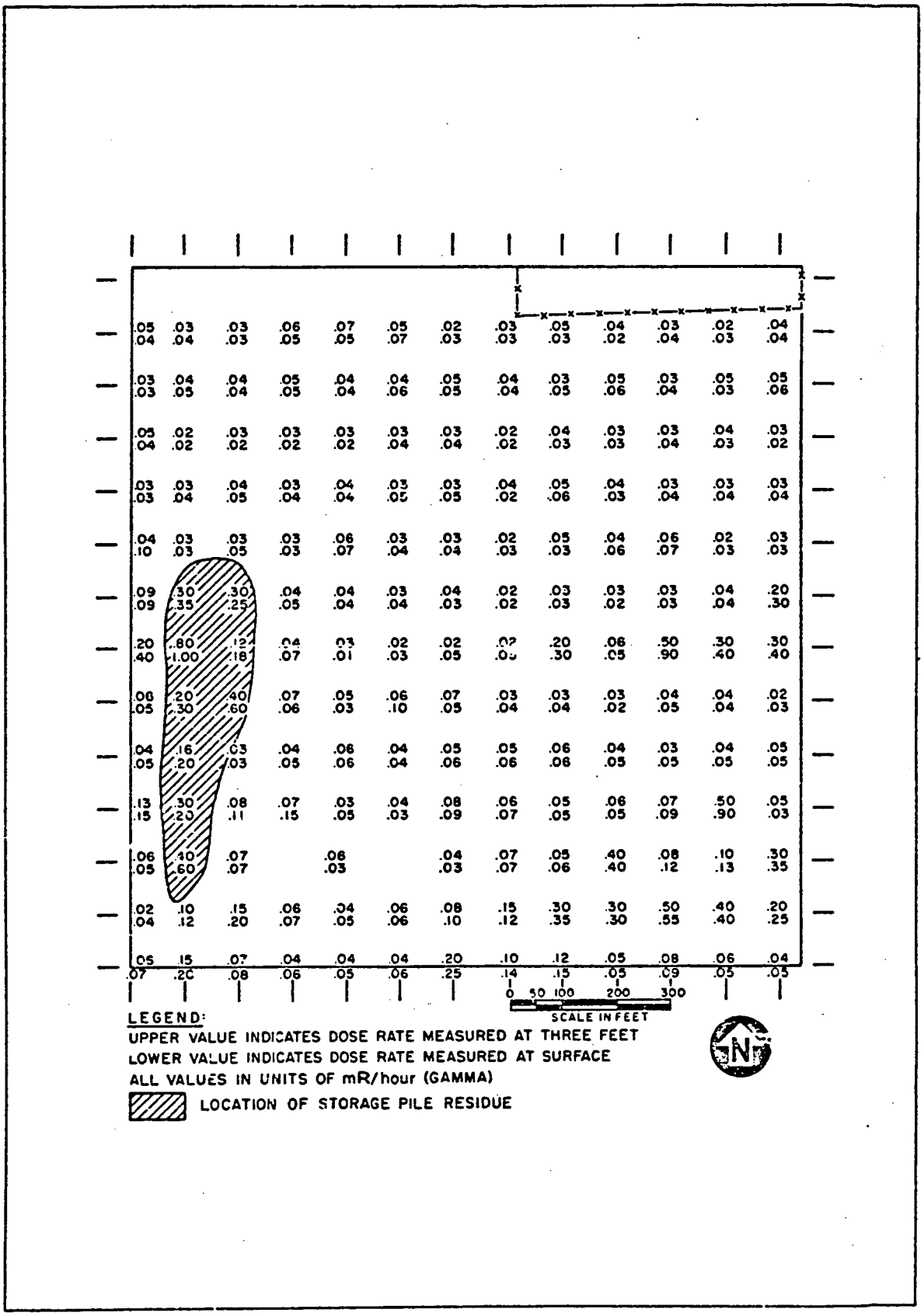

Fig. 9 Radiation survey measurements -- Lot 1, Ore Storage Area, Monticello Project, San Juan County, Utah.

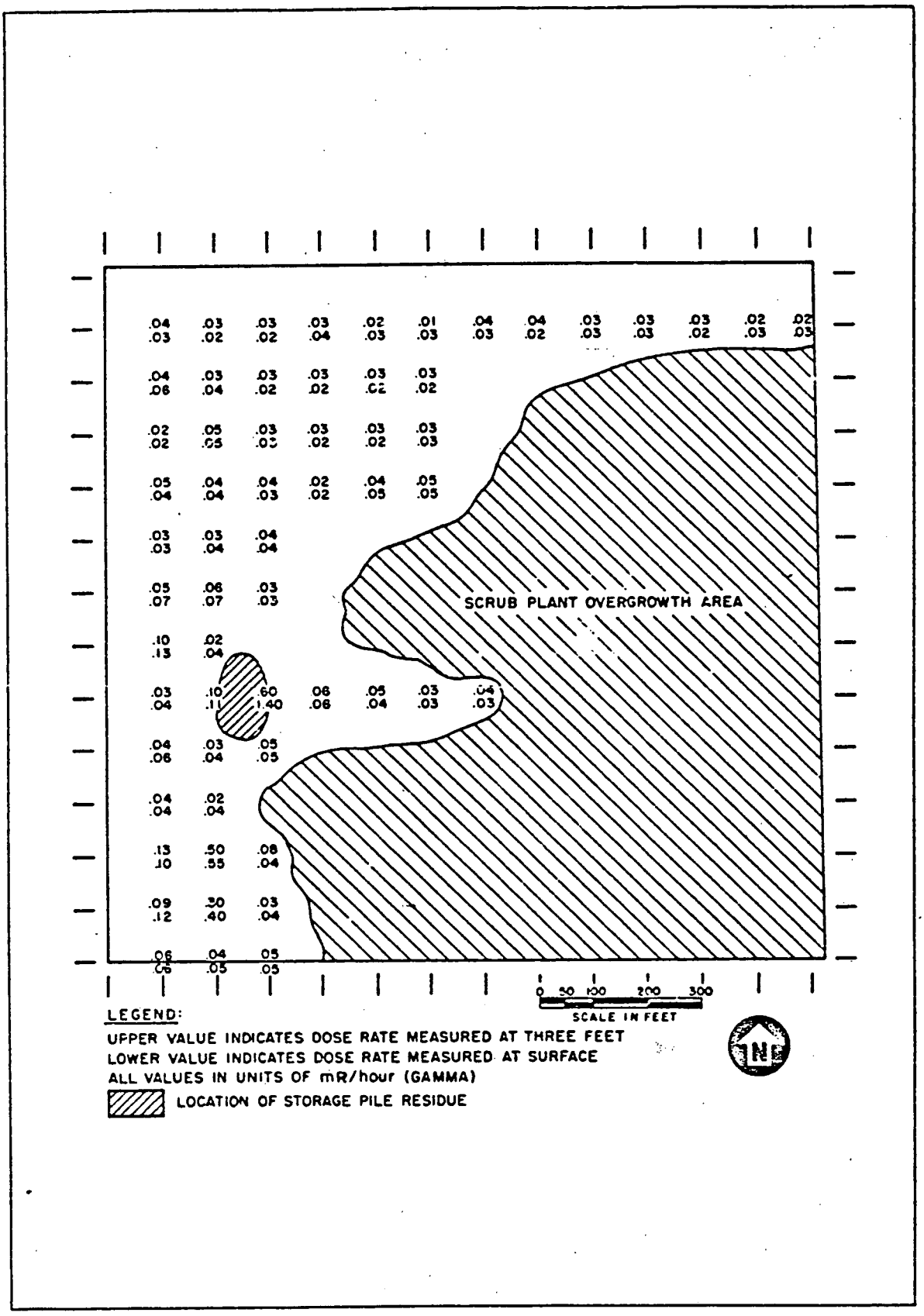

Fig. 10 Radiation survey measurements -- SE^4 of SW^4 Sec. 31, Ore Storage Area, Monticello Project, San Juan County, Utah.

Based on the results described above, it can be concluded that there is no radiation hazard at the ore storage area and the 80-acre plot can be released for public usage without any restriction.

4.4 Administration Area

This area consisted of approximately 450,000 ft^2 in the extreme northwest corner of the site. Five buildings remained in this area which overlooked the mill and tailing area. Appraisal of this area consisted of detailed radiation surveys of each of the buildings and of ground surveys along traverses believed representative of usage traffic patterns. Figure 1 shows the locations of reference buildings.

4.41 Building 1 -- Administration Building. Radiation surveys using beta-gamma and alpha detection instruments were performed along the baseboards in each of the rooms and along the traffic areas in corridors, doorways, and exits. Miscellaneous fixtures including tables, shelving, and counters were included in the survey. The only area not included in the survey was the vault which was inaccessible to entry. The results obtained from these measurements showed no detectable contamination; all beta-gamma measurements were in the range of 0.04 to 0.05 mrad/hour (background included); and all alpha measurements were less than 500 disintegrations per minute per probe area.

4.42 Building 3 -- Sampling Plant Office Building. Except for the inclusion of considerably more miscellaneous equipment, the building was surveyed in a manner comparable to that described for Building 1. Trace evidence of contamination was evident on the floor and on equipment at several work locations where material was repetitively handled. Except for these few locations, beta-gamma dose rates were less than 0.05 mrad/hour (background included), and alpha contamination was less than 500 disintegrations/minute/100 cm^2. The following tabulation itemizes the exceptions:

Location	Contamination Values	
	mrad/hour	dis/min/100 cm^2
East Entrance Foyer		
Crushed base	0.35	12,000
Floor	0.35	500
Drying Room		
Floor at ovens 1 and 2	0.2	2,000
Work bench north and south ends	0.3	1,400
Shelves	0.1	1,400
Steel floor plate	0.15	2,200
Southeast Room		
Floor	0.15	500
Front Room		
Floor, entrance and mat	0.15	500

4.43 Building 35 -- Laboratory. Again, following survey methods previously described, the general beta-gamma dose rates were less than 0.05 mrad/hour (background included), and alpha contamination was less than 500 dis/min/100 cm^2. Exceptions to these values were dose rates of 0.2 mR/hour on a waste basket in a closet, 0.2 mR/hour on an old ore sack in the basement, 0.5 mR/hour over an area in the southwest corner of the furnace room, and 0.2 mR/hour emanating from the sump. The only alpha contamination detected was 3000 dis/min/100 cm^2 over dried sludge deposited in the southwest corner of the furnace room.

4.44 Building 48 -- Scale House. A thorough survey of equipment and exposed surfaces revealed no detectable contamination.

4.45 Building 51 -- Change House. Trace contamination was detected on nearly all equipment items; however, the interior exposed surfaces of the building were found to be within the range of radiation background in the area. Items showing dose rates in the range to 0.3 mR/hour included a grill, shower cabinet, washing machine, lockers, tables, benches, and a fan base. Alpha contamination in the range of 200 to 300 dis/min/100 cm^2 was detected in the washing machine, in a locker, and on the base of a fan. The alpha measurements in the washer may be conservative due to geometric influence.

4.46 Summary of Building Survey Data. Considering the magnitude of floor and wall areas surveyed in these buildings, the presence of detectable contamination on exposed building surfaces can be deemed negligible. Excluding equipment, the only area requiring decontamination prior to release or sale is the dried material in the furnace room of Building 35. Visual inspection of this deposited material indicated that contamination levels would likely increase if the material was disturbed, and care should be exercised to assure complete removal.

The contaminated equipment described above falls into two general categories, (a) equipment that has been excluded from sale on the basis of previous survey information and (b) sundry equipment having a summary value so negligible that the cost of any decontamination effort would be precluded. Considering the nuisance problems that may evolve and the low dollar value, it is recommended that all contaminated equipment described above be destroyed prior to sale of the facilities.

4.5 Foundation Area

The lower foundation area included six foundations, spaced 30 to 40 feet apart and varying in length from approximately 50 feet to several hundred feet. The area between foundations contained remnants from the building removal and concrete floors from old process areas. For reference purposes, the foundations were numbered one through six from south to north. The tabulation on page 20 summarizes some of the higher gamma and alpha measurements obtained during the foundation area survey.

As indicated by the results in the table, this region is generally contaminated. The actual survey appraisal was believed on the conservative side as (a) the instrument readings, particularly for alpha contamination, were low or impossible to obtain due to the high moisture content caused by rain the previous

Location	Contamination Detected[a]
Foundations Nos. 1 and 2	
Compressor wall -- east	1.5 mR/hour
Yellow cake area wall	0.5 mR/hour
Dryer foundation	9.5 mR/hour
CO_2 regeneration area	0.2 to 0.6 mR/hour
Compressor wall -- northwest	0.3 to 6.5 mR/hour, 9000 dis/min
Yellow cake area floor	0.5 to 7.5 mR/hour
Filter press floor	9500 dis/min
North wall -- cake area	1.5 to 11 mR/hour, 8000 dis/min
Tank room wall	0.1 to 5.0 mR/hour
Foundation No. 3	
General levels	0.1 to 0.2 mR/hour, 500 dis/min
Isolated spots	0.4 to 1.0 mR/hour, 3000 dis/min
Foundation No. 4	
General levels	0.1 to 0.2 mR/hour, 1500 dis/min
Isolated spots	0.7 to 10 mR/hour, 45,000 dis/min
RIP Building Foundations	
South wall (first 125 feet)	0.3 to 0.7 mR/hour
Soutn wall (125 to 140 feet)	1.0 to 7.0 mR/hour

[a] Alpha measurements in disintegrations per minute per probe area of 58 cm^2.

24 hours and (b) highly contaminated areas had been painted and removal of paint or general deterioration often resulted in exposing contaminated areas several orders of magnitude higher than adjacent locations. Yellow cake deposits were commonly visible in many of these locations.

The survey findings tend to preclude the release of the foundation area in its present condition for public usage. Practical actions which would allow release are (a) to completely cover the foundations with dirt or (b) to demolish the concrete structures, bury them, and cover the residual area with a few feet of dirt. The latter appears more practical for those foundations projecting above ground level. The demolished foundations could be buried and covered at the present location.

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